

REMARKS

Claims 1-16 are pending in the above-identified application and stand rejected. Applicant, having amended the specification and claims, respectfully requests reconsideration.

Objection to the Specification

The examiner objected to applicant's disclosure because "the specification contains at least two blank spaces at page 1" (Office Action, page 2). The foregoing amendments insert appropriate serial numbers into those blank spaces, so the objection should be withdrawn. Other minor amendments correct obvious typographical errors. No new matter is added.

Claim Objections

The examiner objects to claim 12 due to the recitation of a "third material layer" between a first material layer and the third material layer. The foregoing amendment to claim 12 places the third material layer between first and second material layers, and thus overcomes this objection. Applicant thanks the examiner for his attention to detail.

Rejections Under 35 U.S.C. 112

Claims 11-16 stand rejected under section 112, second paragraph, as indefinite. With respect to claim 11, the examiner notes the step of forming a second mask "raises a question that [sic] how the second mask is formed through the exposed portion of the second material layer, wherein

the first material layer is disposed over the second material layer" (Office Action, pages 2-3).

Figures 50-65 support all of the claims, including claims 11-16. Some of the features illustrated in Figures 50-65 are formed in the bottom of the depicted structures. This convention is employed because the depicted structures are patterned from two sides. During the process of forming the features on the bottom surface, the structures of e.g. Figures 52 and 53 are inverted, so layers that appear above other layers in Figures 52 and 53 are beneath those layers from the process perspective. The reader should keep this in mind when viewing the text describing the process of Figures 50-65 and the related claims. For example, layers 6000 and 5005 provide support for first and second material layers recited in some claims. While layer 5005 is "beneath" layer 6000 in the Figures, layer 6000 is beneath layer 5005 from the process perspective. The claims, each of which recites a method, are written from the process perspective.

Applicant has amended claim 11 to more clearly recite the invention. The amendments to claim 11 find support in e.g. applicant's Figures 50-65 and the related text. Claims 12-16 depend from claim 11, so the clarifying amendments to claim 11 apply equally to claims 12-16. The rejections of claims 11-16 should therefore be withdrawn.

Claim Rejections Under 35 U.S.C. 103

Claims 1-16 stand rejected under section 103(a) as unpatentable over Niedermann et al. (Niedermann) in view of Farino et al. (Farino). Applicant respectfully disagrees

with the assessment, taking each claim rejection in turn as follows.

Claim 1

Claim 1 recites a photolithographic method of patterning "a first material layer disposed beneath a second material layer...of a thickness and having a first surface in contact with the first material layer and a second surface..." The method of claim 1 includes "forming a first mask over...the second material layer..." This step is supported, for example, in Figures 52 and 53, which show an oxide layer 5105 patterned to form a mask 5310.

Referring to Figure 58, oxide layer 6000 provides support for the recited "first material layer" and a silicon layer 5005, alone or in combination with layer 5310, provides support for the recited "second material layer" (recall that the first material layer 5015 is "disposed beneath" the second material layer 5005 from the process perspective). In the second step of claim 1, the second material layer is etched down to the first material layer (e.g. layer 5005 is etched down to layer 6000 as shown in Figure 60), a second mask (e.g., 5900) is then formed in the well defined within the etched portion of the second layer. Instead of focusing on the bottom of the well, the photolithography equipment is first focused on the top surface, from the process perspective, and then adjusted by an offset to account for the depth of the well. This methodology is discussed e.g. in Applicant's specification at paragraph 0074.

Referring first to Niedermann, Figures 2E-2G in particular, Niedermann teaches a number of patterning steps for shaping a silicon layer 8A. As noted by the examiner, however, Niedermann remains silent about adjusting the focus of a photolithographic image by an offset.

The examiner finds support for the "adjusting the focus" step of applicant's claim 1 in Farino. In the examiner's words, in Farino "the focus is automatically adjusted based on the thickness of the material layer to be etched for providing devices having sub-micron lateral dimensions" (Office Action, bridging pages 3 and 4). The examiner then concludes that "it would have been obvious to one skilled in the art at the time of the claimed invention to combine Farino et al's teaching into Niedermann et al's process for providing devices with sub-micron lateral dimensions as taught by Farino et al" (Office Action, page 4). Applicant respectfully disagrees.

Referring first to Farino's Figure 3 and the associated text in column 8, the Farino process begins by patterning the upper surface of a wafer 22 after "an auto-focusing projection stepper" exposes a first photo resist layer 52 (column 8, lines 12 and 13). Later, in a step depicted in Farino's Figure 5, the Farino process patterns a lower surface of wafer 22 after once again focusing the projection stepper, this time on the bottom surface of a "focusing cavity" (see Farino's column 9, lines 30-51). The focusing cavity is thus employed to determine the optical mask focus for structure formed in the bottom of an associated device cavity 36.

The method of claim 1 differs from that taught in Farino, and this important difference obviates the need for a focusing cavity. Instead of using a focusing cavity, the method of claim 1 patterns a first material layer exposed through a second material layer by focusing a photolithographic image on the second material layer, adjusting the focus by an offset, and then forming a second mask over the first material layer.

The examiner may be arguing that, in focusing first on one layer and then on another, Farino performs the "focusing" and "adjusting" steps of claim 1. This would be incorrect, however, as both the "focusing" and "adjusting" steps of claim 1 occur after "forming a first mask over...the second material layer," whereas only one focusing step and no adjusting step follows the first mask formation in the Farino process. The second focusing step taught in Farino might be considered a focusing step or an adjusting step, but it makes no sense to consider the second focusing step in Farino to be a focusing step followed by an offsetting step in the manner claimed.

Neither Farino nor Niedermann teach a method that includes a focusing step followed by "adjusting the focus of [a] photolithographic image by an offset" in the manner claimed. The rejection of claim 1 should be rejected.

Claims 2-10

Claims 2-10 depend from claim 1, and consequently distinguish Niedermann and Farino for at least the same reasons that claim 1 distinguishes. The rejections of claims 2-10 should therefore be withdrawn.

Claim 11

Amended claim 11 recites a photolithographic process sequence for manufacturing MEMS structures. The recited teaches two focusing steps, both of which form respective photolithographic images on a "second material layer." Following the second focusing step, claim 11 recites a step of "defocusing the second photolithographic image by an offset..." Neither Niedermann nor Farino teach two focusing steps to be performed on the same layer, nor does either reference teach two focusing steps, one followed by a defocusing step. In the absence of such teaching or suggestion, the rejection of claim 11 as obvious over Farino and Neidermann should be withdrawn.

Claims 12-16

Claims 12-19 depend from claim 11, and consequently distinguish the cited references for at least the same reasons that claim 11 distinguishes. The rejections of claims 12-16 should therefore be withdrawn.

NEW CLAIMS

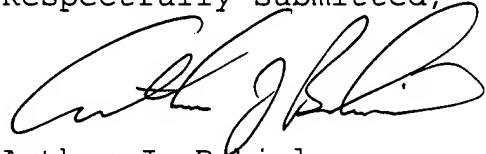
Applicant has added new claims 17-19, each of which depends from claim 16. New claims 17-19 consequently distinguish the cited references for at least the same reasons that claim 12 distinguishes.

CONCLUSIONS

For the reasons presented above, the pending claims are believed to be in a condition for allowance; accordingly,

Applicant respectfully requests a Notice of Allowance. If the Examiner's next action is other than allowance of the pending claims, the examiner is requested to call applicants' representative at (925) 621-2113.

Respectfully submitted,



Arthur J. Behiel
Attorney for Applicants
Reg. No. 39,603

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Mail Stop, Commissioner for Patents, PO Box 1450 Alexandria, VA, 22313-1450, on November 17, 2003

Laurie Moreno
Name


Signature